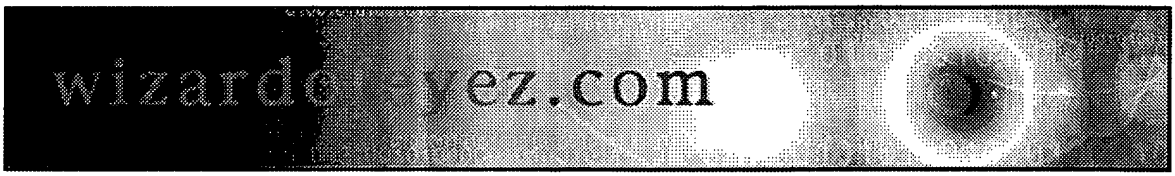


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## TMG (Trimethylglycine):

### Methyl-donor:

Methylation is a natural process of transfer of methyl groups (-CH3) between different compounds. This can serve to activate, recycle, detoxify and/or protect the affected molecules. Research shows that decreased methylation is involved in many health conditions, including diseases of the cardiovascular system, brain and liver, as well as cancer. Methylation is a key biochemical step ocurring a billion times a second. A coating of methyl groups on DNA protects against aging, oxidation and genetic damage.

Trimethylglycine (TMG) is an excellent source of methyl groups and is found in good quantities in broccoli and beets. TMG (Trimethyl glycine) is also known as anhydrous betaine, glycine betaine, or oxyneurine. It is a white crystalline powder with a naturally sweet taste and it disolves readily under the tongue for sublingual absorption, or for those who prefer, in water or other drinks. TMG is sometimes confused with betaine hydrochloride, which is also found in nutritional products, but as a stomach acidifier.

### Cardiovascular-Health:

The focus on dietary cholesterol has thrown many people off the track. Dietary cholesterol is not the main source of blood cholesterol. And blood cholesterol is not the main risk factor for cardiovascular disease. Animals fed normal diets with the addition of high amounts of cholesterol do not develop atherosclerosis. A much higher risk factor is elevated homocysteine (HCY) levels. In the Physicians(1) Health Study, doctors with high homocysteine levels were found to have 3 to 4 times higher risk for heart attack compared to those with lower levels.

Four major modifiable factors affect homocysteine levels:

- the rate of conversion of homocysteine to methionine via methylation
- the rate of homocysteine conversion to cystathionine and cysteine via transsulfuration
- the amount of homocysteine excreted into the plasma by cells
- the level of methionine in the diet.

TMG is one of the most powerful methylating agents known and has

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been shown to lower homocysteine levels when nothing else would.

**Cancer-Prevention:**

Methylation regulates the expression of genes by coating the DNA, selectively turning some genes on and others off. Young people typically start out with enough methyl groups to regulate genetic activity, but these are lost during mitosis (cell division) due to dietary deficiency. The result is expression of oncogenes, which leads to cancer. Optimum methylation of the DNA prevents cancer by inhibiting oncogenes. Dietary intake of high levels of methyl donors is linked to low cancer rates, and animal studies show that methyl donor supplementation prevents cancer in .

**Aging-Reversal:**

DNA methylation also helps explain the mechanisms of aging. DNA expression determines the building blocks and functions of all cells. With aging-related loss of DNA methylation, genetic expression changes. Methylation is a process of biochemical reduction (addition of electrons), the opposite of oxidation (loss of electrons). TMG is a potent antioxidant as well as a methyl donor, so it feeds both sides of the age-reversal equation. TMG also helps oxygenation at the cellular level, which further reduces aging related oxidation of the cell structures such as DNA and cell membrane. Oxygen is needed as a receptor for spent electrons from mitochondrial respiration, to prevent backup of electrons in the electron transport chain leading to leakage of high energy electrons (free radicals). By reversing atherosclerosis, TMG also provides enhanced circulation and tissue oxygenation over time with supplementation.

**Mood-Elevation and Liver-Health:**

Methylation increases production of S-adenosyl-methionine, or SAMe. SAMe is an excellent antidepressant without the side effects of trycyclics. SAMe is very useful in liver disease and in osteoarthritis it has been shown to stimulate cartilage regeneration. TMG is an excellent way to elevate bodily SAMe synthesis, and should always be taken by those supplementing SAMe according to the Remission Foundation. When SAMe is spent, it loses a methyl group to become homocysteine. TMG recycles the homocysteine back into SAMe, so with enough TMG in the system, the same SAMe molecule can be used over and over, never staying in the toxic homocysteine form for long enough to damage the vascular system.

**TMG-Research-Abstracts:**

**Evaluation of radiation injury by 1H and 31P NMR of human urine.**

Yushmanov VE

Institute of Chemical Physics, Russian Academy of Sciences, Moscow.

Magn Reson Med, 1994 Jan, 31:1, 48-52

1H and 31P NMR techniques were applied to study the changes in metabolite profiles in human urine resulting from radiation exposure following the Chernobyl reactor accident. In cases of acute leukemia and different accumulated doses of external radiation (from 0.20 to 4.00 Sv), the proton spectra were classified on the basis of the peaks due to **N-trimethyl groups**, creatinine, citrate, glycine, and hippurate. Unidentified resonances were observed between 15.9 and 21.4 ppm in six phosphorus spectra of patients with preleukemia and acute leukemia. Characteristic spectral changes were similar for external radiation and incorporation-induced internal irradiation. The spectral patterns described may serve as a criterion of radiation injury.

Unique Identifier 94166611

JOURNAL ARTICLE ISSN 0740-3194

**Betaine:homocysteine methyltransferase--a new assay for the liver enzyme and its absence from human skin fibroblasts and peripheral blood lymphocytes.**

Wang JA; Dudman NP; Lynch J; Wilcken DE

Department of Cardiovascular Medicine, Prince Henry Hospital, University of New South Wales, Sydney, Australia.

Clin Chim Acta, 1991 Dec 31, 204:1-3, 239-49

Chronic elevation of plasma homocysteine is associated with increased atherogenesis and thrombosis, and can be lowered by **betaine (N,N,N-trimethylglycine)** treatment which is thought to stimulate activity of the enzyme betaine:homocysteine methyltransferase. We have developed a new assay for this enzyme, in which the products of the enzyme-catalysed reaction between betaine and homocysteine are oxidised by performic acid before being separated and quantified by amino acid analysis. This assay confirmed that human liver contains abundant betaine:homocysteine methyltransferase (33.4 nmol/h/mg protein at 37 degrees C, pH 7.4). Chicken and lamb livers also contain the enzyme, with respective activities of 50.4 and 6.2 nmol/h/mg protein. However, phytohaemagglutinin-stimulated human peripheral blood lymphocytes and cultured human skin fibroblasts contained no

detectable betaine:homocysteine methyltransferase (less than 1.4 nmol/h/mg protein), even after cells were pre-cultured in media designed to stimulate production of the enzyme. The results emphasize the importance of the liver in mediating the lowering of elevated circulating homocysteine by **betaine**.

Unique Identifier 92306342

JOURNAL ARTICLE ISSN 0009-8981

Country of Publication NETHERLANDS

CAS Registry/EC Number EC 2.1.1. (Methyltransferases); EC 2.1.1.5 (betaine-homocysteine methyltransferase); 107-43-7 (Betaine); 454-28-4 (Homocysteine); 7005-18-7 (Methionine)

**1H NMR determination of urinary betaine in patients with premature vascular disease and mild homocysteinemia.**

Lundberg P; Dudman NP; Kuchel PW; Wilcken DE Address Department of Biochemistry, University of Sydney, NSW, Australia.

Clin Chem, 1995 Feb, 41:2, 275-83

Urinary **N,N,N-trimethylglycine (betaine)** and N,N-dimethylglycine (DMG) have been identified and quantified for clinical purposes by proton nuclear magnetic resonance (1H NMR) measurement in previous studies. We have assessed these procedures by using both one-dimensional (1-D) and 2-D NMR spectroscopy, together with pH titration of urinary extracts to help assign 1H NMR spectral peaks. The **betaine** calibration curve linearity was excellent ($r = 0.997$, $P = 0.0001$) over the concentration range 0.2-1.2 mmol/L, and CVs for replicate **betaine** analyses ranged from 7% ($n = 10$) at the lowest concentration to 1% ($n = 9$) at the highest. The detection limit for **betaine** was < 15 mumol/L. Urinary DMG concentrations were substantially lower than those of **betaine**. Urinary **betaine** and DMG concentrations measured by 1H NMR spectroscopy from 13 patients with premature vascular disease and 17 normal controls provided clinically pertinent data. We conclude that 1H NMR provides unique advantages as a research tool for determination of urinary **betaine** and DMG concentrations.

Unique Identifier 95179851

JOURNAL ARTICLE ISSN 0009-9147

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